

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A copper alloy for welding electrodes, characterized in that wherein the copper alloy contains, as a second element, which that does not dissolve or scarcely dissolves in copper in a solid solution state at room temperature, said second element being selected from the group consisting of any of chromium (Cr), zirconium (Zr), beryllium (Be), titanium (Ti) and boron (B), the respective addition ratios of the second elements element being Cr: 0.1 to 1.4 wt%, Zr: 0.15 to 0.5 wt%, Be: 0.1 to 3.0 wt%, Ti: 0.1 to 6.0 wt%, B: 0.01 to 0.5 wt%, in that this and wherein the alloy has an average crystal grain size of not more than 20 μ m, in that the second elements element precipitates among crystal grains, and in that the copper alloy has a hardness of not less than 30 HRB, an electrical conductivity of not less than 85 IACS%, and a thermal conductivity of not less than 350 W/(m·K).
2. (Cancelled)
3. (Cancelled)
4. (Cancelled)

5. (Currently Amended) A method of manufacturing a copper alloy for welding electrodes, comprising the steps of:

~~characterized in that the method comprises enabling any of chromium (Cr), zirconium (Zr), beryllium (Be), titanium (Ti) and boron (B) to dissolve in a solid solution in a base-material metal (Cu) as a second element that does not dissolve or scarcely dissolves in copper in a solid solution state at room temperature, the wherein respective addition ratios of the second elements element being Cr: 0.1 to 1.4 wt%, Zr: 0.15 to 0.5 wt%, Be: 0.1 to 3.0 wt%, Ti: 0.1 to 6.0 wt%, B: 0.01 to 0.5 wt%,~~

~~subsequently achieving crystal grain refinement by applying a strain equivalent to an elongation of not less than 200% to this material to achieve crystal grain refinement, and~~

~~-subjecting this material to aging treatment simultaneously with or after the subsequent to application of this strain, thereby to promote-promoting precipitation of the second element among crystal grains.~~

6. (Cancelled)

7. (Currently Amended) The method of manufacturing a copper alloy for welding electrodes according to claim 5, ~~characterized in that means for applying a strain to the material strain is applied to the material by is any of extrusion extruding, drawing, shearing, rolling and forging.~~

8. (Currently Amended) The method of manufacturing a copper alloy for welding

electrodes according to claim 7, ~~characterized in that conditions for the extrusion wherein strain is applied by extruding the material, and extrusion conditions are such that lateral extrusion is performed at a material temperature of 400 to 1,000°C, a die temperature of 400 to 500°C, and an extrusion speed of 0.5 to 2.0 mm/sec.~~

9. (Currently Amended) The method of manufacturing a copper alloy for welding electrodes according to ~~any of claims 5, 7 or 8, characterized in that claim 5, wherein the material is subjected to aging treatment before a strain is applied to the material, the material is subjected to aging treatment beforehand.~~

10. (Currently Amended) A composite copper material for welding electrodes, ~~characterized in that wherein~~ an alumina powder or a titanium boride powder is dispersed in a copper matrix in an amount of 0.1 to 5.0 wt%, ~~said and in that~~ this composite copper material has a hardness of ~~at least~~ not less than 30 HRB, an electrical conductivity of ~~not less than~~ ~~at least~~ 85 IACS%, and a thermal conductivity of ~~not less than~~ ~~at least~~ 350 W/(m·K).

11. (Cancelled)

12. (Cancelled)

13. (Cancelled)

14. (Currently Amended) A method of manufacturing a composite copper

material, comprising the steps of:

~~mixing that comprises mixing a copper powder and a ceramic powder together to forming, thereby to form a mixed powder as a primary shaped body, and applying a strain to said this primary shaped body, thereby to form a secondary shaped body in which base material and ceramic particles are combined together with refined particle sizes,~~

~~wherein characterized in that the an average particle size of the ceramic powder is between about 0.3 to 10 μm , in that at the strain applied to the primary shaped body is equivalent to an elongation of not less than 200%, in that the means for the strain is applied by extruding the primary shaped body applying a strain is extrusion that is performed at a material temperature of not less than 400°C but not more than 1,000°C and a die temperature of not less than 400°C but not more than 500°C, in that the wherein an average particle size of a base material of the secondary shaped body to be obtained is not more than 20 μm , and in that the average particle size of ceramic particles is not more than 500 nm.~~

15. (Cancelled)

16. (Currently Amended) The method of manufacturing a composite copper material according to claim 14, characterized in that ~~wherein~~ the primary shaped body is obtained by green compacting or by filling the mixed powder in a tube.

17. (Cancelled)

18. (Currently Amended) A method of manufacturing a composite copper material in which titanium boride is dispersed in a copper matrix, ~~characterized in that the method comprises~~comprising the steps [1] to [3] below of:

- [1] ~~the step of~~ mixing a copper powder, a titanium powder and a boron powder together, thereby to form a primary shaped body;
- [2] ~~the step of~~ applying thermal energy to the primary shaped body, and thereby causing the titanium powder and the boron powder to react with each other in order to form titanium boride in a~~the~~ copper matrix; and
- [3] ~~the step of~~ applying a strain to the primary shaped body, in which the titanium boride is formed, by plastically deforming the primary shaped body, and thereby ~~to form~~ forming a secondary shaped body.

19. (Currently Amended) The method of manufacturing a composite copper material according to claim 18, ~~characterized in that~~ wherein the secondary shaped body is subjected to heat treatment ~~while in the same step as the step of applying a~~ the strain by plastic deformation ~~or a step following this step or following application of the strain.~~

20. (Currently Amended) The method of manufacturing a composite copper material according to claim 18, wherein or 19, ~~characterized in that~~ the plastic deformation involves applying a strain equivalent to an elongation of not less than 200%.

21. (Currently Amended) The method of manufacturing a composite copper

material according to ~~any of claims 18 to 20, characterized in that claim 18, wherein~~ the plastic deformation is extrusion that is performed at a material temperature of not less than 400°C but not more than 1000°C.

22. (Currently Amended) The method of manufacturing a composite copper material according to ~~any of claims 18 to 20, characterized in that claim 18, wherein~~ the plastic deformation is extrusion that is performed at a die temperature of not less than 400°C but not more than 500°C.

23. (Currently Amended) The method of manufacturing a composite copper material according to ~~any of claims 18 to 22, characterized in that claim 18, wherein~~ the primary shaped body is obtained by green compacting or by filling a mixed powder in a tube.

24. (Currently Amended) The method of manufacturing a composite copper material according to ~~any of claims 18 to 23, characterized in that claim 18, wherein~~ ~~the an~~ average particle size of the ceramic powder is 0.3 to 10 μm , ~~in that the an~~ average particle size of a base material of the secondary shaped body to be obtained is not more than 20 μm , and ~~in that the an~~ average particle size of titanium boride particles is not more than 500 nm.